USDA Natural Resources Conservation Service

Ecological site R030XB055CA
Shallow Hill

Last updated: 2/24/2025
Accessed: 05/12/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 030X–Mojave Basin and Range

The Mojave Desert Major Land Resource Area (MLRA 30) is found in southern California, southern Nevada, the extreme southwest corner of Utah and northwestern Arizona within the Basin and Range Province of the Intermontane Plateaus. The Mojave Desert is a transitional area between hot deserts and cold deserts where close proximity of these desert types exert enough influence on each other to distinguish these desert types from the hot and cold deserts beyond the Mojave. Kottek et. al 2006 defines hot deserts as areas where mean annual air temperatures are above 64 F (18 C) and cold deserts as areas where mean annual air temperatures are below 64 F (18 C). Steep elevation gradients within the Mojave create islands of low elevation hot desert areas surrounded by islands of high elevation cold desert areas.

The Mojave Desert receives less than 10 inches of mean annual precipitation. Mojave Desert low elevation areas are often hyper-arid while high elevation cold deserts are often semi-arid with the majority of the Mojave being an arid climate. Hyper-arid areas receive less than 4 inches of mean annual precipitation and semi-arid areas receive more than 8 inches of precipitation (Salem 1989). The western Mojave receives very little precipitation during the summer months while the eastern Mojave experiences some summer monsoonal activity.

In summary, the Mojave is a land of extremes. Elevation gradients contribute to extremely hot and dry summers and cold moist winters where temperature highs and lows can fluctuate greatly between day and night, from day to day and from winter to summer. Precipitation falls more consistently at higher elevations while lower elevations can experience long intervals without any precipitation. Lower elevations also experience a low frequency of precipitation events so that the majority of annual precipitation may come in only a couple precipitation events during the whole year. Hot desert areas influence cold desert areas by increasing the extreme highs and shortening the length of below freezing events. Cold desert areas influence hot desert areas by increasing the extreme lows and increasing the length of below freezing events. Average precipitation and temperature values contribute little understanding to the extremes which govern wildland plant communities across the Mojave.

Arid Eastern Mojave Land Resource Unit (XB)

LRU notes

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the Arid Eastern Mojave LRU where precipitation is bi-modal, occurring during the winter months and summer months. The Arid Eastern Mojave LRU is designated by the 'XB' symbol within the ecological site ID. This LRU is found across the eastern half of California, much of the mid-elevations of Nevada, the southernmost portions of western Utah, and the mid-elevations of northwestern Arizona. This LRU is essentially equivalent to the Eastern Mojave Basins and Eastern Mojave Low Ranges and Arid Footslopes of EPA Level IV Ecoregions

Elevations range from 1650 to 4000 feet and precipitation is between 4 to 8 inches per year. This LRU is

distinguished from the Arid Western Mojave (XA) by the summer precipitation, falling between July and September, which tends to support more warm season plant species. The 'XB' LRU is generally east of the Mojave River and the 117 W meridian (Hereford et. al 2004). Vegetation includes creosote bush, burrobush, Nevada jointfir, ratany, Mojave yucca, Joshua tree, cacti, big galleta grass and several other warm season grasses. At the upper portions of the LRU, plant production and diversity are greater and blackbrush is a common dominant shrub.

Ecological site concept

This ecological site is found on hill and mountain landforms below 3800 feet elevation. Between 2800 and 3800 feet elevation the site is found on south facing slopes. Below 2800 feet elevation the site is found on all slopes. Soils are very shallow and developed in colluvium and residuum from conglomerate sources.

This site is part of ecological site group R030XB124NV

Associated sites

R030XB001NV	**LIMY HILL 5-7 P.Z.**
R030XB005NV	**Arid Active Alluvial Fans**
R030XB028NV	**VALLEY WASH**
R030XB030NV	**SHALLOW LIMESTONE SLOPE 5-7 P.Z.**

Similar sites

R030XB026NV	**GYPSIC LOAM 3-5 P.Z.** ATHY codominant shrub; less productive site; soils have high amounts of gypsum
R030XB117NV	**GYPSIC SAND 3-5 P.Z.** ATCA2 and PEPA13 important shrubs; soils have high amounts of gypsum
R030XB124NV	**SHALLOW HILL 3-5 P.Z.** This is the same ecological site but was copied to this description in order to prevent identification duplication in the event the
R030XB126NV	**GRAVELLY PEDIMENT 5-7 P.Z.** AMDU2-ATCO codominant; less productive site
R030XB003NV	**GYPSIC LOAM 5-7 P.Z.** PEPA13 & LEFR2 important shrubs; more productive site; soils have high amounts of gypsum
R030XB127NV	**SHALLOW SANDSTONE SLOPE 3-5 P.Z.** ATC0 dominant shrub
R030XB109NV	**GYPSIC BARREN 3-5 P.Z.** PEPA13 and EPTO codominant shrubs; soils have high amounts of gypsum

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Psorothamnus fremontii*

Physiographic features

This site occurs on all aspects although primarily on southerly exposures of hills. Slopes range from 8 to 50 percent. Elevations are 2000 to 3800 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill
Elevation	610–1,158 m

Slope	8–50%

Climatic features

The climate is hot and arid, with mild winters and very hot summers. Precipitation is greatest in the winter with a lesser secondary peak in summer, typical of the Mojave Desert. The average annual precipitation ranges from 3 to 5 inches with most of the moisture falling as rain during the period November through March. At least 30% of the annual precipitation occurs from July to September as a result of summer convection storms. Mean annual air temperature is 64 to 69 degrees F. The average frost-free period is 240 to 300 days.

Table 3. Representative climatic features

Frost-free period (average)	300 days
Freeze-free period (average)	
Precipitation total (average)	127 mm

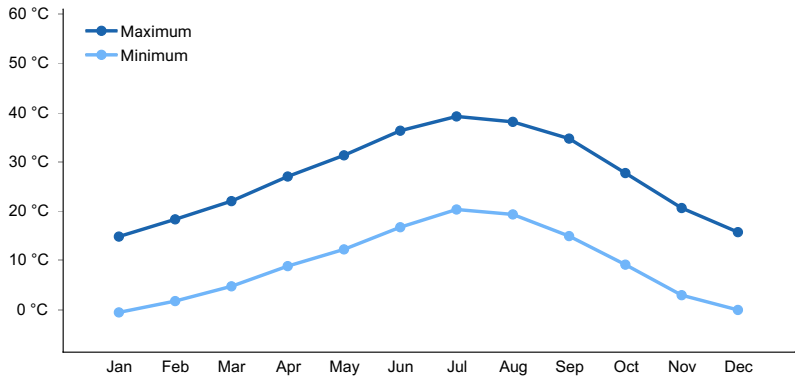


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soil associated with this site are well drained and are very shallow to bedrock. They are formed in residuum and colluvium from sandstone conglomerate. Runoff is very high and permeability is moderately rapid.

Table 4. Representative soil features

Drainage class	Well drained
Permeability class	Moderately rapid

Ecological dynamics

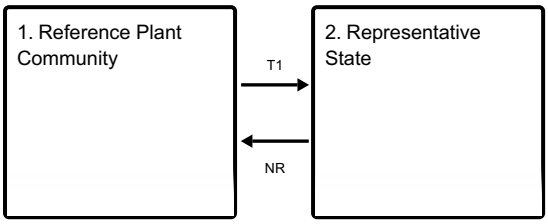
As ecological condition deteriorates, total shrub canopy decreases and large openings develop between individual shrubs. Creosotebush may increase. With a loss of perennial cover, non-native annual grasses and forbs may invade this site. Threadleaf snakeweed will increase following disturbance of this site.

Fire Ecology:
Fires in the Mojave desert are infrequent and of low severity because production of annual and perennial herbs seldom provides a fuel load capable of sustaining fire. Fire generally kills white bursage. However, most white bursage plants burned because their canopies contained numerous small branches in proximity to herbaceous fuels. Fires in creosotebush scrub were an infrequent event in pre-settlement desert habitats, because fine fuels from winter annual plants were probably sparse, only occurring in large amounts during exceptionally wet winters.

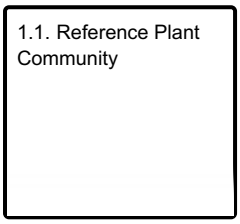
Fire kills many creosotebush. Creosotebush is poorly adapted to fire because of its limited sprouting ability. Creosotebush survives some fires that burn patchily or are of low severity. Nevada ephedra is top-killed by fire. Underground regenerative structures commonly survive when aboveground vegetation is consumed by fire. Nevada ephedra generally sprouts after fire damages aboveground vegetation and may increase in plant cover. Green ephedra generally sprouts vigorously from the roots or woody root crown after fire and rapidly produces aboveground biomass from surviving meristematic tissue. It is capable of reestablishing disturbed areas through seed. Green ephedra has been found in plant communities with a wide range of fire return intervals, and has been found in ecosystems following large, stand replacing fires as well as small, patchy, erratic fires. Green ephedra establishes early after fire but with relatively low occurrence compared to mid- and late successional stages.

State and transition model

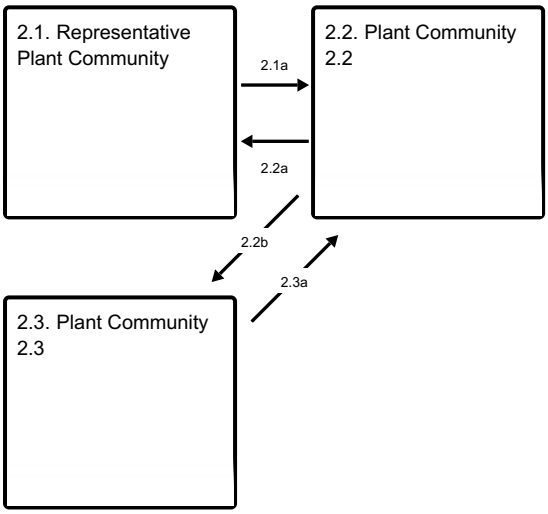
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Reference Plant Community

The reference state is representative of the natural range of variability under pristine conditions. Community phase changes are primarily driven by natural disturbances such as long-term drought and insect attack. Wildfire is infrequent and patchy due to low fuel loading and widely spaced shrubs. Timing of disturbance combined with weather events determines plant community dynamics.

Community 1.1
Reference Plant Community

Fremont dalea dominates the reference plant community. Potential vegetative composition is about 5% annual and perennial grasses, 5% annual and perennial forbs, and 90% shrubs. Approximate ground cover (basal and crown) is less than 5 percent (˜3%).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	50	151	252
Grass/Grasslike	3	9	15
Forb	2	8	13
Total	**55**	**168**	**280**

State 2
Representative State

The Representative State is characterized by the presence of non-native species. A biotic threshold is crossed with the introduction of non-native annuals that are difficult to remove from the system and have the potential to alter disturbance regimes significantly from their historic range of variability. Theses non-native annuals are highly flammable and promote wildfire where fires historically have been infrequent.

Community 2.1
Representative Plant Community

This plant community is similar to the reference plant community with a trace of non-natives in the understory. Ecological function has been not compromised at this time. Ecological resilience is reduced by the presence of non-native species and this plant community phase will respond differently following a disturbance when compared to non-invaded plant communities.

Community 2.2
Plant Community 2.2

This plant community is characteristic of a post-disturbance plant community. It is initially dominated by herbaceous vegetation, woody perennials are increasing. Short lived and pioneering shrubs provide favorable microsites for the establishment of long lived shrub seedlings.

Community 2.3
Plant Community 2.3

This plant community is characterized by a short disturbance return interval. Non-native annuals take advantage of the increased availability of resources. This plant community is identified as “at risk”. The loss of vegetative cover has reduced the ecological resistance and resilience. Management should be focused on limiting disturbances and protecting remnants of mature vegetation to ensure a seed source is available in the future.

Pathway 2.1a
Community 2.1 to 2.2

Frequent and repeated surface disturbances, wildfire, disease, insect attack, or any other type of incomplete vegetation removal.

Pathway 2.2a
Community 2.2 to 2.1

Absence from disturbance and natural regeneration over time.

Pathway 2.2b
Community 2.2 to 2.3

Frequent and repeated surface disturbances, wildfire, disease, insect attack, or any type of vegetation removal.

Pathway 2.3a
Community 2.3 to 2.2

Absence from disturbance and natural regeneration over time.

Transition T1
State 1 to 2

Introduction of non-native species due to a combination of factors including; surface disturbance, changes in the kinds of animals and their grazing patterns, drought, changes in fire history or any other type of vegetation removal.

Restoration pathway NR
State 2 to 1

No Recovery (NR) - Non-native annuals species have become naturalized in these systems creating an unlikely scenario to restore the site back to reference.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			1–17	
	threeawn	ARIST	*Aristida*	1–9	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	1–9	–
	big galleta	PLRI3	*Pleuraphis rigida*	1–9	–
	slim tridens	TRMU	*Tridens muticus*	1–9	–
2	**Annual Grasses**			1–9	
Forb					
3	**Perennial forbs**			1–17	
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	1–9	–
4	**Annual forbs**			1–9	
Shrub/Vine					
5	**Primary shrubs**			111–168	
	Fremont's dalea	PSFR	*Psorothamnus fremontii*	101–118	–
	creosote bush	LATR2	*Larrea tridentata*	3–17	–
	burrobush	AMDU2	*Ambrosia dumosa*	3–17	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	2–9	–
	mormon tea	EPVI	*Ephedra viridis*	2–9	–
6	**Secondary shrubs**			9–26	
	catclaw acacia	ACGR	*Acacia greggii*	2–6	–
	Fremont's chaffbush	AMFR2	*Amphipappus fremontii*	2–6	–
	sweetbush	BEJU	*Bebbia juncea*	2–6	–
	Eastern Mojave buckwheat	ERFAP	*Eriogonum fasciculatum var. polifolium*	2–6	–
	white ratany	KRGR	*Krameria grayi*	2–6	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	2–6	–
	woody crinklemat	TICA3	*Tiquilia canescens*	2–6	–
	Mojave woodyaster	XYTO2	*Xylorhiza tortifolia*	2–6	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production, steep slopes and stony surfaces. White bursage is of intermediate forage value. It is fair to good forage for horses and fair to poor for cattle and sheep. However, because there is often little other forage where white bursage grows, it is often highly valuable to browsing animals and is sensitive to browsing. Creosotebush is unpalatable to livestock. Consumption of creosotebush may be fatal to sheep. Nevada ephedra is important winter range browse for domestic cattle, sheep and goats. Nevada ephedra is usually grazed heavily and seems to be perfectly safe for grazing livestock since it induces neither toxicity in ewes or cows, nor congenital deformities in lambs. Green ephedra is an important browse species for big game and domestic livestock. It is heavily browsed by livestock and big game on winter range but only moderately or lightly browsed during other seasons. Green ephedra stems and twigs are nearly all within reach of grazing animals, and can serve as winter forage because they extend above the snow.

Stocking rates vary over time depending upon season of use, climate variations, site, and previous and current management goals. A safe starting stocking rate is an estimated stocking rate that is fine tuned by the client by adaptive management through the year and from year to year.

Wildlife Interpretations:
White bursage is an important browse species for wildlife. Creosotebush is unpalatable to most browsing wildlife. Mule deer, bighorn sheep, and pronghorn browse Nevada ephedra, especially in spring and late summer when new growth is available. Mountain quail eat Ephedra seeds. Green ephedra is also of importance to small mammals; the stem parts and sizeable seeds are favored by many small mammals.

Hydrological functions

Runoff is very high and permeability is moderately rapid.

Other products

White bursage is a host for sandfood, a parasitic plant. Sandfood was a valuable food supply for Native Americans. Creosotebush has been highly valued for its medicinal properties by Native Americans. It has been used to treat at least 14 illnesses. Twigs and leaves may be boiled as tea, steamed, pounded into a powder, pressed into a poultice, or heated into an infusion. Some Native American tribes steeped the twigs of Nevada ephedra and drank the tea as a general beverage.

Other information

White bursage may be used to revegetate disturbed sites in southwestern deserts. Once established, creosotebush may improve sites for annuals that grow under its canopy by trapping fine soil, organic matter, and symbiont propagules. It may also increase water infiltration and storage.

Other references

Fire Effects Information System (Online; http://www.fs.fed.us/database/feis/plants/).

Hereford, R., R.H. Webb and C. I. Longpre. 2004. Precipitation history of the Mojave Desert region, 1893-2001 (No. 117-03).

Kottek, M., Grieser, J., Beck, C., Rudolf, B., & Rubel, F. (2006). World map of the Köppen-Geiger climate classification updated. Meteorologische Zeitschrift, 15(3), 259-263.

Salem, B. B. (1989). Arid zone forestry: a guide for field technicians (No. 20). Food and Agriculture Organization (FAO).

USDA-NRCS Plants Database (Online; http://www.plants.usda.gov).

Contributors

PN-E/GKB
Dustin Detweiler

Approval

Sarah Quistberg, 2/24/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/12/2025
Approved by	Sarah Quistberg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

---

14. **Average percent litter cover (%) and depth (in):**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

---

17. **Perennial plant reproductive capability:**
